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FOREST INSECT AND DISEASE CONDITIONS IN ONTARIO, 1981

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ABSTRACT

This report reviews the status of forest insects and diseases in Ontario in 1981 and gives, for some pests, a forecast of conditions for 1982. Six economically important forest insects (three conifer and three hardwood insects), two tree diseases, and maple decline are discussed in detail; many other noteworthy insects and diseases are listed in tabular form. Special surveys conducted by the Forest Insect and Disease Survey Unit and provincial forest insect control programs are described. A list of publications and unpublished results is provided. More detailed information is available on request from the Great Lakes Forest Research Centre.

RÉSUMÉ

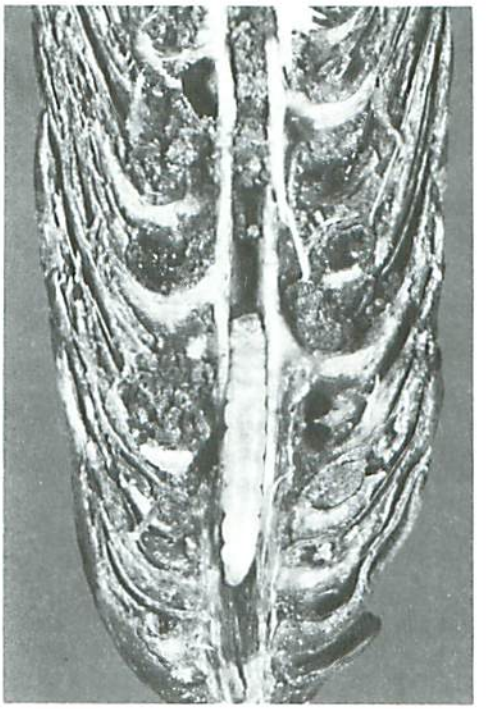
Le présent rapport fait le point sur les insectes forestiers et les maladies des arbres en Ontario en 1981 et donne, pour certains ravageurs, une prévision des conditions qui prévaudront en 1982. Six insectes forestiers d'importance économique, dont trois s'attaquant aux résineux et une aux feuillus, deux maladies des arbres et le déclin des érables sont traités en détail; plusieurs autres insectes et maladies dignes de mention apparaissent sous forme de tableaux. Des enquêtes spéciales menées par le Relevé des insectes et maladies des arbres ainsi que dans le cadre des programmes provinciaux de lutte contre les insectes forestiers sont décrits dans le rapport. Une liste des publications et d'articles connexes est fournie. Des renseignements supplémentaires sont disponibles sur demande au Centre de recherches forestières des Grands Lacs.

ACKNOWLEDGMENTS

This report is the result of a combined effort of all members of the Forest Insect and Disease Survey Unit at the Great Lakes Forest Research Centre with the support and cooperation of the Ontario Ministry of Natural Resources.

Frontispiece

Maple decline



Spruce seed moth (*Laspeyresia youngana* [Kft.]) feeding on a white spruce cone.

Scleroderris canker (*Gremmeniella abietina* [Lagerb.] Morelet): North American race on jack pine stem.

Swaine jack pine sawfly (*Neodiprion swainei* Midd.): colony of larvae feeding on jack pine foliage.

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INTRODUCTION

The forests of Canada are continually attacked by a large variety of destructive insects, diseases and abiotic agents. The usual results of these attacks are tree mortality and growth loss; however, other forms of impact include disrupted management plans, interrupted harvest schedules, inadequate regeneration, reduced seed production and the creation of hazardous fire situations. Hence, knowledge of pest problems and of the various options available for reducing impact is vital for effective forest management and protection.

The Forest Insect and Disease Survey (FIDS) has traditionally, for more than 40 years, taken the lead role in forest pest surveys in Canada, a function considered to be a federal responsibility. The early duties of FIDS included identification of all forest insect pests and diseases and the gathering of biological data on their life histories and habits. This general biological approach has now narrowed to focus on those pests which past records show are economically or potentially important, and on the detection and identification of new forest pest problems. Hence, the current function of FIDS is to provide broad annual assessments of the status of major forest pests and their effect on the forests. The information collected is used to develop and adjust federal forest protection research programs and to assist in the improvement of provincial forest management and protection practices.

In Ontario, forest protection is the responsibility of the Ontario Ministry of Natural Resources (OMNR). However, protection against insects and disease depends upon reliable detection, identification and evaluation of these damaging agents, and this is the responsibility of the FIDS Unit at the Great Lakes Forest Research Centre. The biological information obtained is used to determine forest entomological and pathological research needs in Ontario, and appears in national compilations on forest insects and diseases. Other responsibilities of the Unit include assistance to the province on pest control operations, public pest extension services, assistance in plant quarantine activities, and special surveys as necessary. The Unit also conducts research in sampling methodology and other areas to improve its own efficiency and to assist in a national effort to develop reliable pest surveys.

Insect and disease survey technicians are in the field from mid-May to late September, conducting extensive aerial and ground surveys. Numerous reports of damage are received from other forestry agencies, including the Ontario Ministry of Natural Resources (OMNR) and the forest industry. Significant pest damage is evaluated by the survey

field technicians. This report is a summary of the records and reports submitted by survey technicians who were assigned as follows to OMNR forest regions in the 1981 field season.

M.J. Thomson and C.G. Jones	Northwestern
W.D. Biggs and V. Jansons	North Central
L.S. MacLeod, W.A. Ingram and D.C. Constable	Northern
K.C. Hall and E.J. Czerwinski	Northeastern
H.J.Weir and H. Brodersen	Algonquin
R.J. Sajan	Eastern
H.J. Evans and C.A. Barnes	Central and Southwestern

Other staff of the Forest Insect and Disease Survey Unit for the 1981-1982 fiscal year were as follows:

M.J. Applejohn, Chief of Survey Field Technicians

F.A. Bricault, Curator, Insect Collection and Herbarium (retired July 1981)

M.C. Davidson, Stenographer

E.B. Dorworth, Mycology, Culture Technician

H.L. Gross, Pathologist

G.M. Howse, Entomologist and Head of the Forest Insect and Disease Survey Unit

H.D. Lawrence, Insect Control Technician

O.H. Lindquist, Insect Taxonomy Technician (retired December 1981)

R.K. McCron, Damage Appraisal Technician

J.H. Meating, Insect Control Officer

D.T. Myren, Mycologist

D.B. Roden, Insect Damage Appraisal Officer

K.L. Smith, Curator, Insect Collection and Herbarium

P.D. Syme, Entomologist

IMPORTANT FOREST PESTS

Spruce Budworm (*Choristoneura fumiferana* [Clem.])

For over a decade the spruce budworm has been Ontario's most serious forest pest problem. The current outbreak, which began in 1967, has continued to expand until, in 1980, some 18.85 million ha were affected. In 1981 the gross area of budworm-infested forest in Ontario decreased by about 633,000 ha to a total of 18.22 million ha (Table 1). As expected, the area within which budworm-associated tree mortality occurred continued to increase in 1981, and now involves an area of approximately 11.21 million ha (Table 2).

Table 1. Comparison of the area of forest in Ontario defoliated by spruce budworm in 1980 and 1981.

Outbreak Region in Ontario	Gross area of moderate-to-severe defoliation (000,000 ha) 1980	1981	Change
Northwestern	.724	.658	- .066
Northeastern	17.119	16.958	- .161
Southern	1.007	.601	- .406
Total	18.850	18.217	- .633

Table 2. Comparison of the area of budworm-associated tree mortality in Ontario in 1980 and 1981.

Region in Ontario	Gross area of budworm-associated tree mortality (000,000 ha) 1980	1981	Change
Northwestern	.024	.088	+ .064
Northeastern	6.839	9.572	+2.733
Southern	1.493	1.550	+ .057
Total	8.356	11.210	+2.854

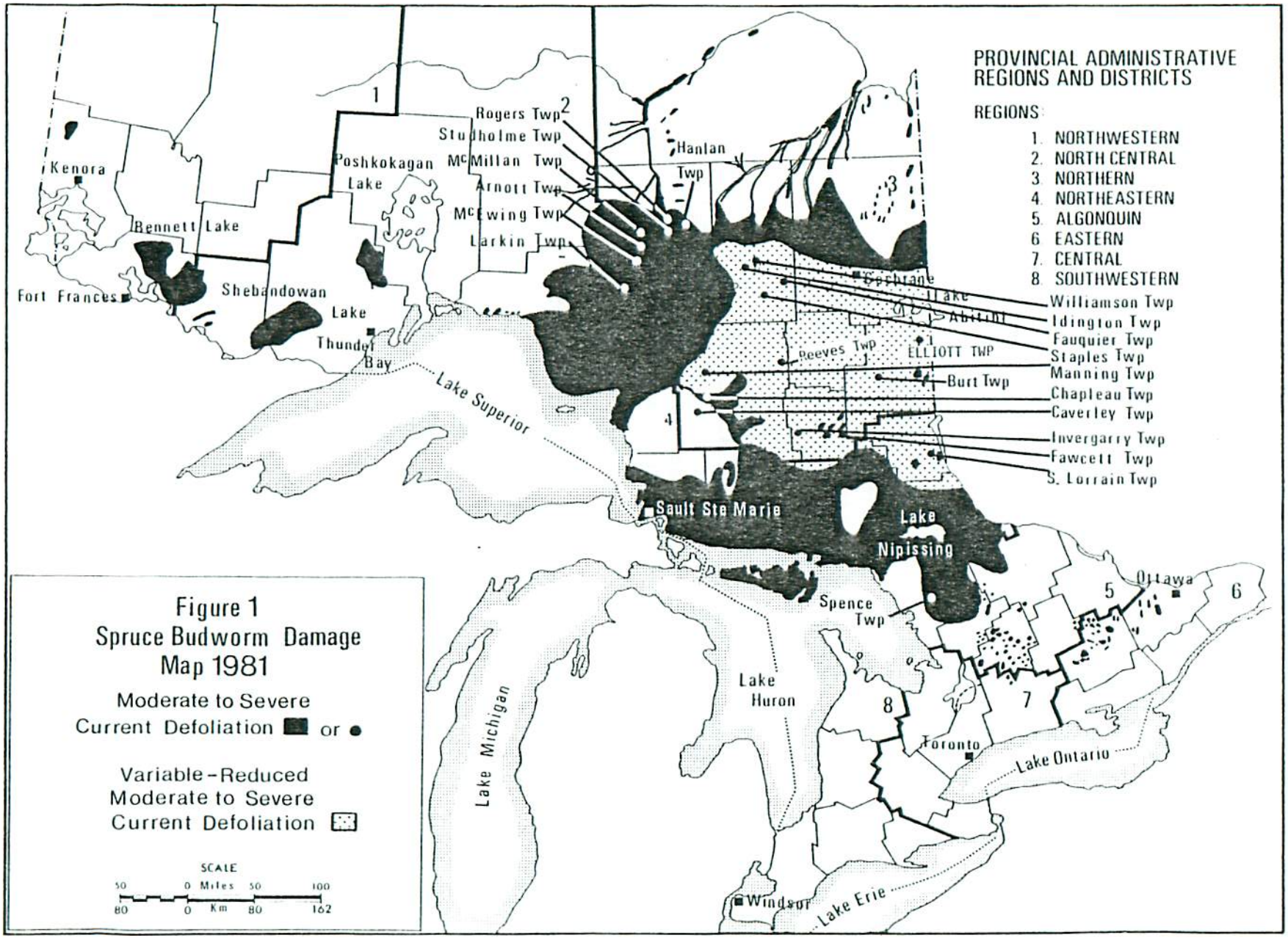
In Ontario, the spruce budworm feeds on balsam fir *(Abies balsamea* [L.] Mill.), white spruce *(Picea glauca* [Moench] Voss), and black spruce *(Picea mariana* [Mill.] B.S.P.) growing on upland sites in mixed stands. Figures presented in this report describing area affected by budworm actually represent gross areas within which stands containing one or more of the major host species show moderate-to-severe current defoliation or in difficult-to-evaluate instances, signs of previous damage. Areas within which moderate-to-severe defoliation is present are delineated and mapped, i.e., defoliation that is detectable from the air is usually considered to be in excess of about 30% of the new growth, and is attributable to spruce budworm. Signs of previous damage may include dead tops and/or dead trees.

Infestations and damage caused by budworm are present in three major geographical areas of the province (Fig. 1): southern Ontario (primarily Algonquin Region), northeastern Ontario (Northeastern and Northern regions) and northwestern Ontario (Northwestern and North Central regions).

In 1981, warmer than normal weather occurred in late February and March; however, unseasonably cool weather in April and early May delayed budworm emergence and slowed development considerably.

In general, larval populations were much lower in 1981 than in previous years. This was not unexpected since the 1980 egg-mass survey had forecast reduced populations in the order of 40-50%. However, in many instances in northeastern and southern Ontario, populations were much lower than expected and the resultant defoliation was quite variable and difficult to map (Fig. 1).

In northwestern Ontario, the total area showing moderate-to-severe defoliation decreased by some 66,500 ha. The bulk of this decrease occurred around the outer edges of the infestation between Kawnipi Lake in the Atikokan District and Lower Shebandowan Lake in the Thunder Bay District. Defoliation in this area decreased by approximately 41,500 ha. Other decreases were noted in Fort Frances District between Bennett Township and Lower Manitou Lake, in Atikokan District near Wolseley Lake, and in Thunder Bay District in the Arrow Lake-Sandstone Lake area and around Poshkokgan Lake. A small infestation found during 1980 at Umfreville Lake, Kenora District, increased in size as defoliation was mapped on the south side of the lake for the first time.

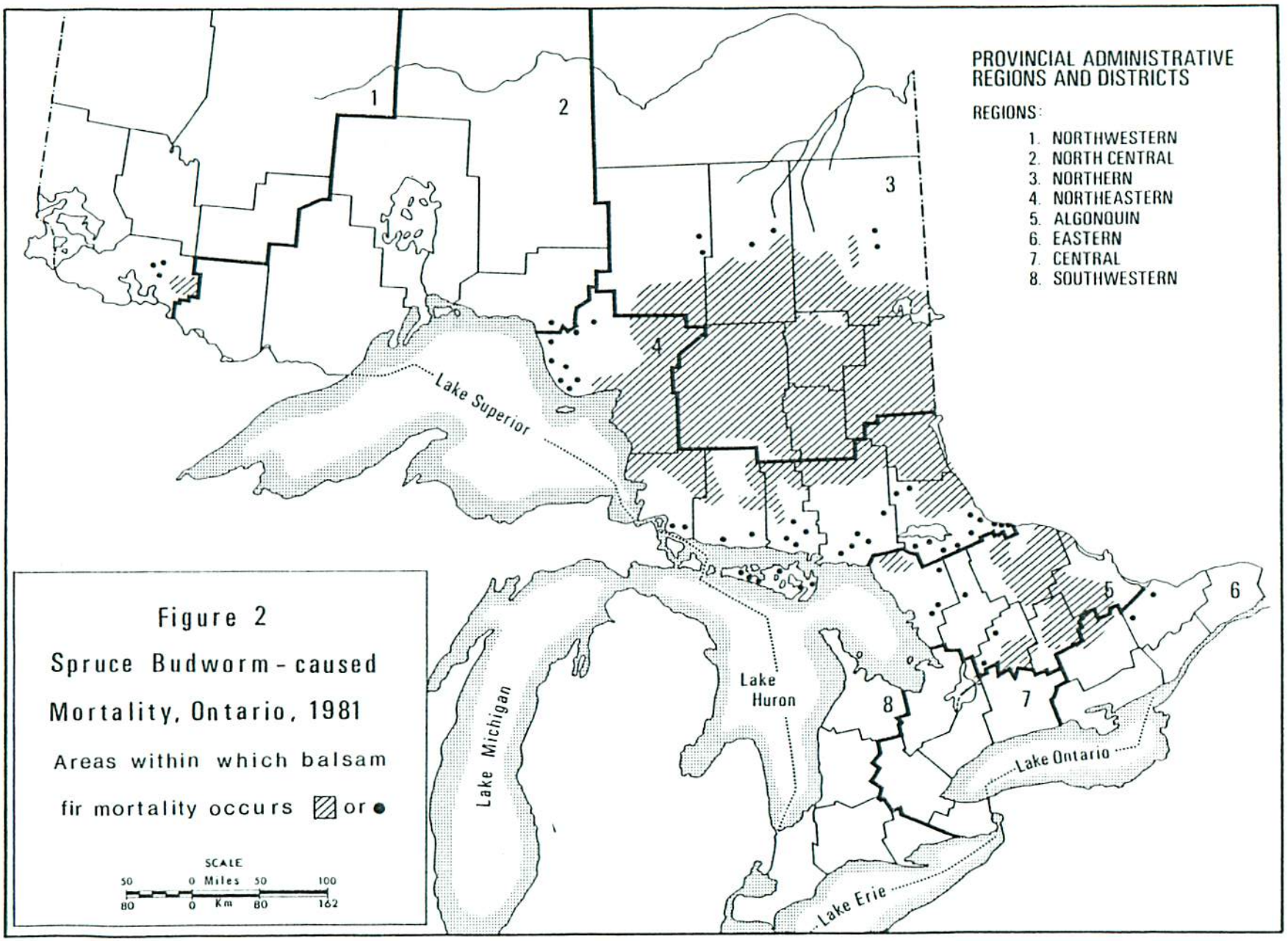

PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Kenora
Fort Frances
Bennett Lake
Shebandowan Lake
Thunder Bay
Lake Superior
Poshkokagan Lake
Rogers Twp
Studholme Twp
McMillan Twp
Arnott Twp
McEwing Twp
Larkin Twp
Hanlan Twp
Sesekinika Lake
Abitibi
Williamson Twp
Idington Twp
Fauquier Twp
Staples Twp
Reeves Twp
ELLIOTT TWP
Manning Twp
Burt Twp
Chapleau Twp
Caverley Twp
Invergarry Twp
Fawcett Twp
S. Lorrain Twp
Sault Ste Marie
Lake Nipissing
Spence Twp
Ottawa
Lake Michigan
Lake Huron
Toronto
Lake Ontario
Windsor
Lake Erie
Figure 1
Spruce Budworm Damage
Map 1981
Moderate to Severe
Current Defoliation or
Variable-Reduced
Moderate to Severe
Current Defoliation
SCALE
50 0 Miles 50 100
80 0 Km 80 162

In northeastern Ontario, the area of moderate-to-severe defoliation increased somewhat in Terrace Bay, Hearst and Cochrane districts and was once again observed along the Albany, Moose and Harricanaw river systems as far north as James Bay in Moosonee District. Damage in the remainder of the northeastern outbreak was moderate to severe, but a large area in the central portion was much more variable than in recent years. This area encompassed the southern parts of the Cochrane and Kapuskasing districts, virtually all of the Timmins, Kirkland Lake, Gogama and Temagami districts, a large portion of the Chapleau District and small areas in the Sudbury and North Bay districts (Fig. 1). Within this area of more than 7 million ha, current defoliation was extremely variable, with ground estimates ranging from a low of 5% to a high of 80%. This situation was further complicated by large patches of dead and dying balsam fir which made defoliation mapping extremely difficult. This is the same part of the province in which cold damage occurred in June, 1980 and caused varying degrees of spruce budworm larval mortality. Over all, areas of moderate-to-severe damage decreased by approximately 161,000 ha in northeastern Ontario in 1981.

This year, the largest decrease in budworm-infested forest occurred in southern Ontario, specifically in the Bancroft, Pembroke and Tweed districts where the area of infestation was reduced by over 190,000 ha (98%). Declines were also mapped in Algonquin Park, Lindsay and Owen Sound districts. Small increases were noted in Parry Sound and Bracebridge districts.

As mentioned earlier, the area within which budworm-associated tree mortality occurred in Ontario increased in 1981 to approximately 11.210 million ha (Fig. 2). In Southern Ontario, most new tree mortality occurred in Tweed and Parry Sound districts. In northeastern Ontario, mortality increased by approximately 2.733 million ha, with new mortality mapped in virtually every district in the Northeastern and Northern regions except Moosonee. In northwestern Ontario, tree mortality increased in the Fort Frances District to 88,000 ha in 1981, up from 24,000 ha in 1980.

The primary hosts of budworm in Ontario were discussed in the 1980 report. Figures were given for the percentage composition by species (based on volume) of primary growing stock on productive forest land in the four northern regions and the Algonquin Region. Since then, estimates have been made of the impact budworm has had on the three major hosts (balsam fir, white spruce and black spruce) between 1977 and 1981. For example, balsam fir growth loss as a result of budworm activity has been estimated at 1.205 million m^3 per year since 1977. Balsam fir mortality during the same period was about 8.915 million m^3 per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3. NORTHERN
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5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 2
Spruce Budworm-caused Mortality, Ontario, 1981
Areas within which balsam fir mortality occurs or
SCALE
50 0 Miles 50 100
80 0 Km 80 162

year, and resulted in a total loss of approximately 10.120 million m^3 annually. The estimated impact on the other major hosts was as follows:

Average annual volume loss from 1977 to 1981 (000,000 m^3)

	Growth loss	Mortality	Total
White spruce	.174	1.529	1.703
Black spruce	.326	1.193	1.519

To date, most of this impact has occurred in the Northern, Northeastern and Algonquin regions. Although infestations decreased slightly in northwestern Ontario in 1981, results of this year's egg-mass survey indicate that these infestations will expand considerably in 1982. If this trend continues, a corresponding increase in the degree of impact can be expected in this part of the province. It has been estimated that the accumulated total loss to date in Ontario exceeds 70 million m^3, and even if the outbreak were to cease overnight, tree mortality would continue for one or two years and losses would increase.

Approximately 650 locations were sampled for egg-mass counts and defoliation estimates during August and September in a province-wide survey. On an overall basis, as in 1980, egg-mass densities declined by 22%. There were major regional differences, however, as substantial increases were recorded in some parts of Ontario, and large declines in others. For the second consecutive year, the largest regional decline in egg-mass numbers, about 52%, occurred in southern Ontario and, as a result, the total area of moderate-to-severe defoliation in the south should continue to decline in 1982. Forecasts call for generally trace or light defoliation interspersed with numerous scattered small pockets of moderate-to-severe defoliation. Similarly, in northeastern Ontario, egg-mass populations declined for the second consecutive year. There was an overall decrease of 46% this year in comparison with 51% in 1980. All but two of the districts in the Northeastern and Northern regions showed significant decreases in egg-mass densities. The two exceptions were Hearst and Espanola, with 25% and 24% increases, respectively. Decreases in the other districts ranged from 18% to 90%. Forecasts call for moderate-to-severe defoliation throughout the area infested in 1981, with the exception that generally light defoliation with scattered pockets of moderate-to-severe defoliation should prevail throughout the central part of the outbreak. In northwestern Ontario, egg-mass densities more than doubled (i.e., the increase was 113% over all) in 1981. There were large increases in Atikokan, Fort Frances, and Thunder Bay, whereas egg-mass populations in Kenora declined somewhat. It is expected that the area of moderate-to-severe defoliation in the north-

west will increase by some 30-40% in 1982 to approximately 1.0 million ha. The extent of accumulated tree mortality for Ontario will likely increase to about 14.0 million ha in 1982.

Forest Tent Caterpillar *(Malacosoma disstria* Hbn.)

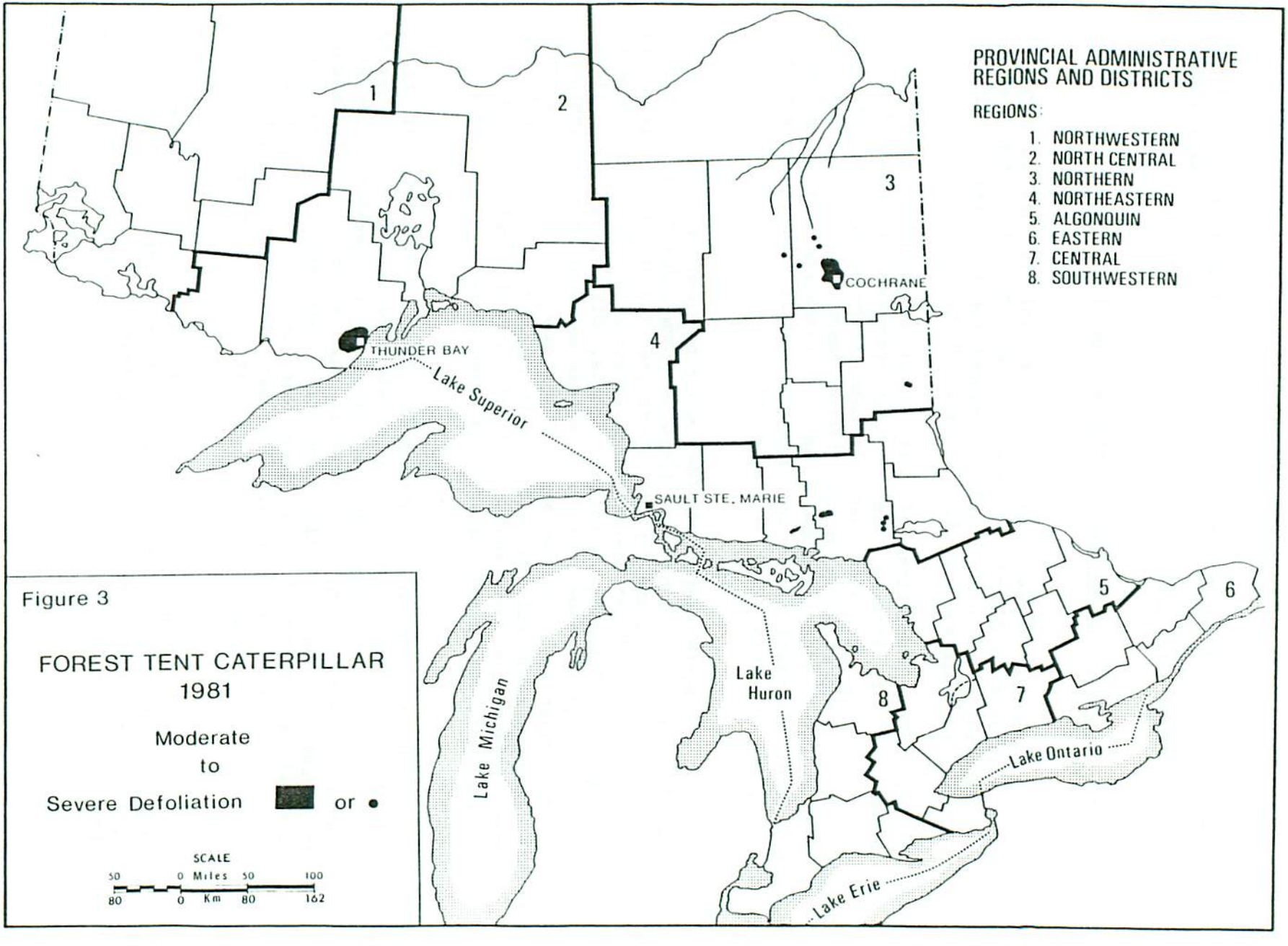
In general, forest tent caterpillar infestations in northern Ontario continued to diminish in area in 1981 (Fig. 3). Moderate-to-severe defoliation of aspen stands was mapped for approximately 228,000 ha in 1981 in comparison with 325,500 ha in 1980.

In 1981, populations of this insect collapsed throughout the area west of Fort Frances, where a light-to-moderate infestation was recorded in 1980. Intensive checks in Lake of the Woods Provincial Park revealed only trace levels of defoliation where light levels had been expected. Defoliation could not be detected elsewhere in the Northwestern Region. Egg-band counts indicate that defoliation is not expected in 1982, and the infestation has collapsed.

In the North Central Region, moderate-to-severe defoliation of hardwoods, mainly trembling aspen *(Populus tremuloides* Michx.), covering approximately 650 km^2, was centred around the city of Thunder Bay. This is an increase of 100 km^2 over the area infested in 1980 and includes at least parts of Paipoonge, Neebing, Scoble, Oliver, McIntyre, Blake, O'Connor and Gillies townships. Populations were not as high within the city of Thunder Bay. On the basis of egg-band counts it is predicted that the population will maintain itself at current levels within the present infestation area and will likely spread considerably to the south and west, with a more moderate increase to the north, in 1982.

Population decline, caused primarily by a hatching failure of the 1980 eggs in the spring of 1981, accelerated in the Northern Region in 1981. Defoliation was moderate over 4 ha in Shackleton Township, southeast of Kapuskasing, and severe in only 93 km^2 in Dack Township near Englehart. However, high populations persisted from Greenwater Provincial Park to the Abitibi River near Cochrane, where 839 km^2 of aspen were severely defoliated. Forecasts for 1982 are that severe defoliation will probably be limited to Leitch and Glackmeyer townships.

In the Northeastern Region, the total area of moderate-to-severe defoliation was reduced from about 121,000 ha to 69,811 ha. The population near North Bay virtually collapsed, leaving only small pockets of light infestation in Jennings, Dunnet, and Casimir townships. The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5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
1
2
3
4
5
6
7
8
COCHRANE
THUNDER BAY
Lake Superior
SAULT STE. MARIE
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 3
FOREST TENT CATERPILLAR
1981
Moderate
to
Severe Defoliation
or
SCALE
50 0 Miles 50 100
80 0 Km 80 162

infestation near Sudbury, which had doubled in size in 1980, declined sharply to only small pockets with moderate-to-severe defoliation in Denison and Drury townships. Populations in Espanola District continued to cause moderate-to-severe defoliation in May, Shakespeare and Baldwin townships. Infection of an *Entomophthora* fungus occurred in late-instar larvae in several areas of the Espanola infestation. Egg-band counts indicate that a decline will occur throughout the district except in Baldwin and Hallam townships to the northwest of Espanola, where high numbers will persist in 1982.

Gypsy Moth (*Lymantria dispar* L.)

The gypsy moth was first detected in Ontario in 1969 on Wolfe Island near Kingston. Since then, small pockets of infestation have been observed at various locations in the Eastern Region, particularly in the Cornwall and Kingston areas. In 1979 the FIDS Unit, in cooperation with Agriculture Canada, began deploying gypsy moth pheromone traps in provincial parks and campgrounds throughout the Northern, North Central and Northeastern regions. In 1981, single male moths were caught at Windy Lake Provincial Park northwest of Sudbury and at Obatanga Provincial Park northwest of Wawa.

In 1981, gypsy moth larvae or defoliation caused by gypsy moth was reported from some 24 locations in the Eastern Region (Fig. 4). Host trees affected were oak, maple, birch, poplar, hickory, pine and basswood. These reports ranged from the presence of a few larvae on a single tree to a few infested trees along roadsides to an area of moderate-to-severe defoliation of approximately 1000 ha of forest in the vicinity of Kaladar in the Tweed District. A total of 1700 ha of moderate-to-severe defoliation and 300 ha of light defoliation was mapped in the Eastern Region in 1981. Other infestations were detected in the city of Ottawa, and in Cornwall, Brockville and Napanee districts. Results of egg-mass surveys conducted in the Kaladar infestations indicate that there is potential for expansion of these infestations in 1982.

Spraying operations were conducted by the Plant Products and Quarantine Division of Agriculture Canada in the Pitts Ferry area, where 243 ha were treated with Sevin-4-oil, and in the city of Oakville, where about 10 ha were treated with Sevin (wettable powder).

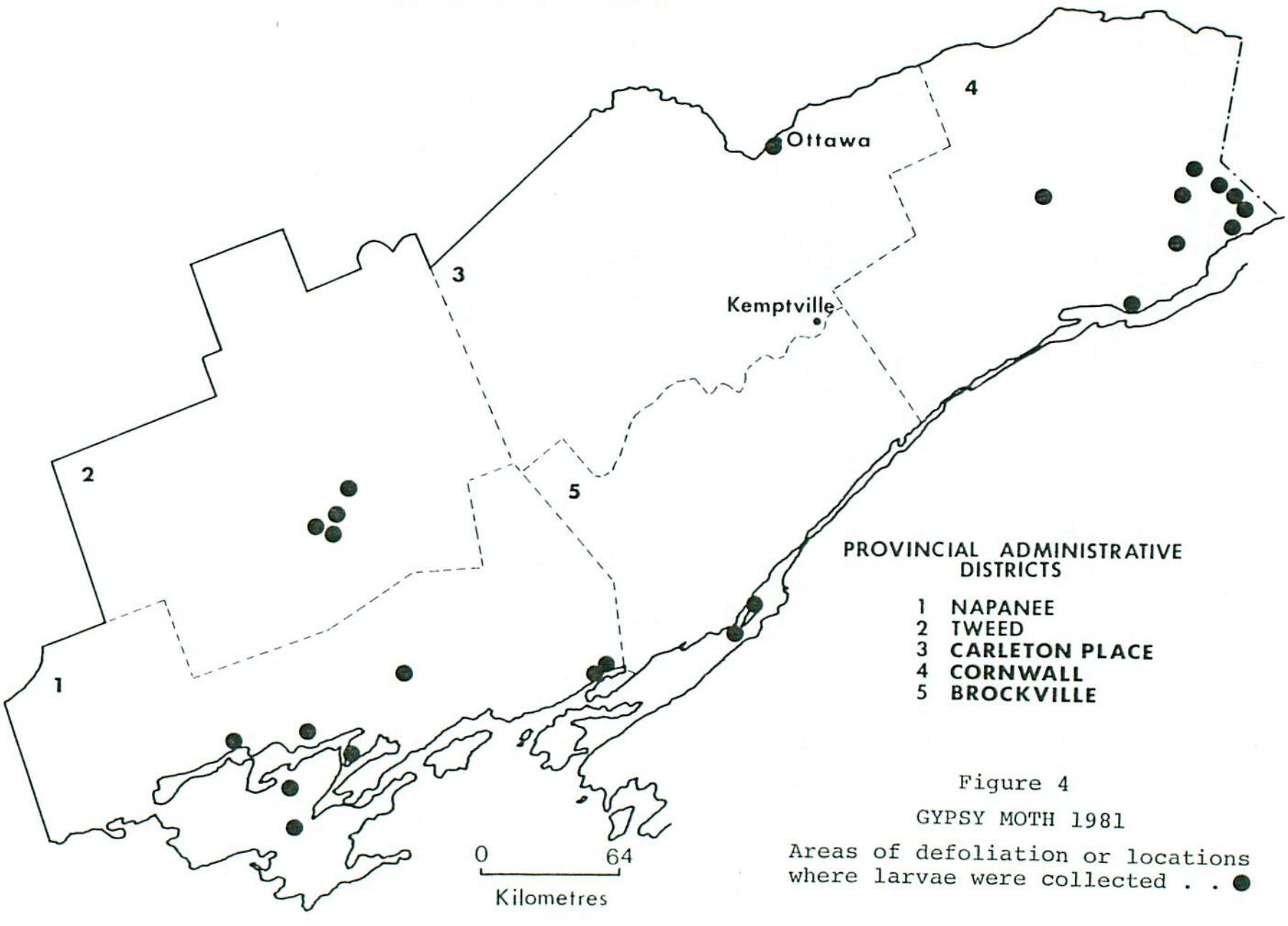

Figure 4

GYPSY MOTH 1981

Areas of defoliation or locations where larvae were collected . . ●

Table 3. Results of surveys of gypsy moth infestations in the Kaladar area, Tweed District, 1981.

Infestation	Area of defoliation 1981 (ha)	Egg masses/ha	Forecasts
1	300 (light)	350	light
2	1,050 (moderate-severe)	28,900	severe
3	250 (moderate-severe)	14,000	severe
4	150 (moderate-severe)	0	nil

Oak Leaf Shredder (*Croesia semipurpurana* Kft.)

The oak leaf shredder is a persistent and widespread pest of red oak (*Quercus rubra* L.) in Ontario. It is considered to be a major factor involved in the condition known as oak decline, which has caused significant mortality of red oak at a number of locations, mainly in the Central Region.

In 1981, populations declined markedly in the Central, Algonquin, and Eastern regions and remained virtually unchanged in the Northeastern Region. The overall area suffering moderate-to-severe defoliation declined from about 50,000 ha in 1980 to about 1,200 ha this year.

In the Central Region, infestations declined to generally low levels, although aerial surveys revealed persistent pockets of moderate-to-severe defoliation in several townships inland from Georgian Bay and on Beausoleil Island in the northern Huronia District. Similar small pockets of medium and heavy infestation persisted in the Uxbridge-Maple area of Maple District. In all areas in the Central Region which were aerially sprayed in 1980 only low populations were encountered. However, the Dufferin County Forest, which was last treated in 1979, became reinfested, with about half the oak stands suffering defoliation in the 50-70% range. In this part of Ontario, oak occurs in mixed hardwood stands in farm woodlots and county forests, with the majority of stands containing some mature trees of merchantable sawlog size. Several years of severe defoliation, along with other factors, have caused significant oak mortality in the southern Maple District and the northern Huronia District. However, since oak deteriorates slowly after dying, some salvage has been possible.

In the Algonquin Region where medium-to-heavy infestations were reported in Dungannon and Cashel townships in 1980, populations declined to low levels. Occasional single trees were moderately defoliated but overall damage to semimature oak-pine forests in both areas was insignificant.

Infestations in the Eastern Region also declined dramatically with the total area suffering moderate-to-severe defoliation being reduced from approximately 10,000 ha in 1980 to about 900 ha in 1981. This defoliation was located in Lavant Township, Carleton Place District, where infestation occurred in mature and semimature stands of mixed hardwoods with an oak content of about 80%. Heavy infestations, which occurred in mixed semimature hardwoods in Abinger and Effingham townships in the Tweed District in 1980, collapsed in 1981.

Populations remain high in the Northeastern Region where scattered small pockets of heavy infestation totalling about 80 ha persist in Sault Ste. Marie and Blind River districts. Increased populations were also reported from a number of locations in Sudbury District and from Manitoulin Island in Espanola District, although overall defoliation in these areas remained light. Infestations in the Northeastern Region occur in immature or semimature stands of mixed hardwood with an oak content of about 25%.

For some years a condition known as oak decline or oak dieback has caused scattered mortality at a number of locations throughout southern Ontario. Oak leaf shredder is considered to be a major predisposing factor in this condition. Since 1977, FIDS has maintained permanent sample plots in all regions of southern Ontario in an effort to monitor the course of oak mortality and to determine some of the factors involved. Initially, 100 live trees in each plot were examined and rated with respect to the percentage of crowns dead. A total of 1,300 red oak trees averaging 21 cm in diameter and 22 m in height have been checked. Results in 1981 show that since 1977, 7% of the trees have died and another 7% are in very serious condition and will probably die.

In an effort to reduce defoliation and prevent mortality, the Ontario Ministry of Natural Resources carried out annual aerial spraying operations from 1977 to 1980 in several hundred hectares of high-value oak-maple forest in the Central Region. Consequently, intensive surveys have been carried out in this region, and although no spraying was done in 1981, the same level of survey effort was maintained as in previous years. Elsewhere, only the extent of defoliation is monitored yearly.

Generally, very low defoliation is expected in 1982 in oak stands in southern Ontario, although a number of scattered pockets of moderate defoliation should occur in the Central Region.

During the 1981 field season FIDS staff undertook a small field trial to determine the possibility of using oak leaf shredder pheromone traps as a tool to predict future populations on the basis of the number of adult male moths caught. The method employed involved the deployment of pheromone traps at locations which are regularly sampled for oak leaf shredder eggs. The number of male moths captured was then compared with the results obtained in the normal egg-mass and defoliation survey. Five pheromone traps were exposed at each sample location with one trap placed among the sample trees and four others placed about 30 m away, with a minimum distance of 30 m between traps. The traps were exposed for the entire period of moth flight and were visited periodically so that those which became swamped with moths could be provided with new sticky bottoms. When the moth flight period was over the traps were collected and the total number of moths captured at each location was tallied in the laboratory. While results obtained showed some inconsistencies, there was evidence that a relationship exists between the number of male moths captured and the number of eggs deposited on the sample trees (Table 4). Further evaluation of the data obtained and refinement of techniques will be necessary before this method can be considered as a possible replacement for the more costly and time-consuming egg surveys which are used at present to predict oak leaf shredder defoliation.

Scleroderris Canker (*Gremmeniella abietina* [Lagerb.] Morelet)

The situation respecting two races of the fungus *Gremmeniella abietina* (Lagerb.) Morelet showed little change.

European race: The results of extensive detection surveys indicated that the European race is not infecting trees in Ontario. Aerial surveys were conducted throughout southern Ontario, and ground checks were performed to identify the cause of any suspicious damage. Also, selected locations with fairly large concentrations of pine are checked thoroughly every other year. In 1981, 70 of these plantations were examined. The procedure used involves inspecting the outside perimeter and two diagonals extending through the stand. Since the European race most commonly infects lower branches, chances are better for detecting the presence of the disease on fringe or open-growing trees. These usually have crowns that extend to ground level; hence, the emphasis on stand perimeters. Again in 1981 while

Table 4. Results of oak leaf shredder pheromone trapping 1981.

Location (property owner)	No. of oak leaf shredder adults captured (total for 5 traps)	No. of spruce budworm adults captured (total for 5 traps)	Percent defoliation	Avg no. of eggs per branch	Defoliation forecast for 1982[a]
Huronia District					
Midhurst Plot 1	371	79	1	2.6	L
Wildman Plot 4	500	41	8	2.6	L
Wildman Plot 7	705	4	44	13.3	M
Awenda Plot 5	711	6	1	2.5	L
Awenda Plot 4	725	4	1	2.3	L
Awenda Plot 11	517	1	19	4.3	L
Danials (Orr Lake)	722	30	41	4.1	L
Uxbridge Plot 1	612	5	27	19.6	M
Uxbridge Plot 2	908	10	19	20.8	M
Dufferin Plot 9	1056	4	57	24.8	M
Dufferin Plot 10	972	1	69	21.0	M
Dufferin Plot 3	1202	6	35	10.4	M
Niagara District					
Plot 5 Iwasykiw	170	8	1	6.3	L
Plot 1 Martin	74	21	1	3.8	L
Plot 2 Wilkins	50	31	1	6.1	L
Plot 3 Hignel	18	25	1	3.1	L
Plot 4 Hinan	31	18	1	5.4	L
Plot 6 Derwinsky	571	18	1	3.0	L
Sault Ste. Marie District					
Hiawatha Park	373	482	32	7.5	L
Blind River District					
Maple Ridge	1232	8	27	4.0	L

[a] L = light (0-25%), M = Moderate (26-75%)

performing other duties, survey field technicians visually checked pine stands for the presence of Scleroderris canker. On the more than 200 additional pine stands that were observed, there was no evidence of the disease.

A workshop was held on 20 May, 1981 in Brockville, Ontario to train OMNR field staff to recognize Scleroderris canker, and to discuss the status of the European race elsewhere in Canada and the United States. Also discussed was the apparently successful containment of the European race in plantations in Quebec and the Maritimes where sanitation was used as a control following detection of the disease. Discussions at the workshop supported a proposal to perform an intensive detection survey in Cornwall District, which is relatively close to locations in Quebec and New York. The survey was contracted to Lakehead University by OMNR. The FIDS Unit helped by training survey crews, processing collections of suspect material, and providing advice on contract specifications. About 130 pine plantations were surveyed in a manner similar to that used by survey technicians (i.e., concentrating on the perimeter and diagonals of a stand).

A favorable year for infection would suggest that the potential remains high for spread into Canada in 1982 from south of the international border.

North American race: This race of the fungus has been known in Ontario at least since 1965. The serological testing of collections made in 1980 throughout the range of Scleroderris canker in Ontario is now complete. Only the North American race was identified. The status of damage caused by the North American race remains unchanged from that reported in 1980.

Dutch Elm Disease (*Ceratocystis ulmi* [Buism.] C. Moreau)

Mortality among the remaining mature white elm (*Ulmus americana* L.) continues to occur at scattered locations throughout southern and central Ontario. Immature elm are also being attacked. Surveys conducted in the Algonquin and Lindsay districts showed that 40-50% of the young elm 10-15 cm in diameter were infected by *C. ulmi* and that some mortality had occurred.

In northwestern Ontario the disease is continuing to spread and intensify. Dead elm were found near Pinewood and in the towns of Rainy

River and Fort Frances. Rainy River has a total of 93 semimature elms free of infection, six infected elms and one elm recently killed by *C. ulmi*. Fort Frances has 565 trees apparently free of infection, 42 infected and three recently killed by the fungus. Infected elm were also found in the Thunder Bay area.

Swaine Jack Pine Sawfly (*Neodiprion swainei* Midd.)

At no time in the history of the Ontario Forest Insect and Disease Survey have infestations of Swaine jack pine sawfly been as extensive as they were in 1981. There was a dramatic increase in the area of moderate-to-severe defoliation in the two infestations delineated in 1980 in the Elk Lake Management Unit, Temagami District, Northeastern Region. Sporadic infestations of this sawfly which resulted in mortality of jack pine (*Pinus banksiana* Lamb.) have been recorded in this general area of Ontario since the early 1940s. Limited salvage cutting has been carried out in accessible semimature and mature stands from time to time.

The Banks-Makobe lakes infestation, which covered 325 ha in 1980, continued to expand in 1981. Some 4,660 ha of jack pine were heavily infested in parts of Banks, Roadhouse, Wallis, Willet and Whitson townships in Kirkland Lake and Temagami districts (Fig. 5). Movement of the infestation was primarily northward. Four permanent plots (100 trees/plot) were established within the 1981 infestation: two in Banks Township and one each in Wallis and Willet townships. As a result of tree suppression, there is already an average of 5% tree mortality in these four stands (range 2-8%). The immediate concern of OMNR personnel is for 23,500 ha of jack pine working group to the north of this infestation, which represents the wood supply for the Elk Lake Management Unit after 1989, as well as several hundred hectares of jack pine plantations.

A second infestation reported in 1980 around Big Boot Lake in Van Nostrand and Klock townships, Temagami District, also increased considerably from 450 ha of moderate-to-severe defoliation in 1980 to 1,035 ha in 1981. The 1980 infestation expanded mainly in a northeasterly direction in Klock Township and into parts of Dane Township, and to the southwest in Van Nostrand Township and into Leo Township. Stands in this area, mainly jack pine, are the result of fires in the late 1920s. Aerial surveys in 1980 showed tree mortality around Big Boot Lake and along the northwest shore of Lady Evelyn Lake. Results of ground surveys indicate that much of this mortality was caused by suppression rather than sawfly damage. If these infestations persist, most of the jack pine will be killed within infested areas.

A small infestation, approximately 20 ha in size, was detected east of the Makobe River in James Township, Kirkland Lake District. Scattered colonies of the sawfly were found in jack pine stands and plantations in Mickle and Corkill townships, Kirkland Lake District; in Gamble, Brewster and McGiffin Townships, Temagami District; and in Lorne Township, Sudbury District. Light defoliation was also observed on islands and shoreline stands on Lake Temagami.

With the high densities of insects observed this year within the infestations, and the presence of an abundant host type outside, there is potential for considerable expansion of the outbreaks in 1982. Because of the impact this sawfly has had on jack pine stands in the past, the potential for spread, and the resource value of the timber in the area, OMNR is considering control action in 1982.

Sawyer Beetles (*Monochamus* spp.)

For the past several years, varying degrees of damage have been caused by the feeding of adult sawyer beetles in the Northern, North Central and Northwestern regions. High populations are usually found when conditions such as fire, drought, or timber harvesting produce an abundant supply of recently killed trees for brood material. Adults then feed on nearby living trees while breeding in the recently dead wood. Feeding damage usually occurs in association with timber harvesting activities where the presence of piled wood, slash and debris serves as a source of attraction to adult beetles. Group seed trees, residual blocks of timber left in checkerboard harvested areas, or the forest at the edge of clearcuts can be damaged. In 1981, damage to standing timber by adult sawyer beetle feeding in the three northern regions was approximately 90 ha in comparison with 200 ha the previous year. The total area within which tree mortality occurred was reduced from 135 ha to 14 ha.

As in previous years, the most extensive damage occurred in the Northern Region. In several areas in Kirkland Lake and Cochrane districts, an early spring breakup resulted in premature deterioration of winter roads, and logs had to be left piled at cutting sites. Adult beetles, attracted to this material, caused conspicuous feeding damage to 16 m jack pine in Wallis Township, Kirkand Lake District and to 10 m black spruce and eastern white cedar (*Thuja occidentalis* L.) in Potter and Thorning townships, Cochrane District. A total of about 40 ha of standing timber was damaged in these areas. Log storage dumps served as the source of attraction for adult beetles at locations in Bristol and Murphy townships, Timmins District, and near Wade Lake, Cochrane

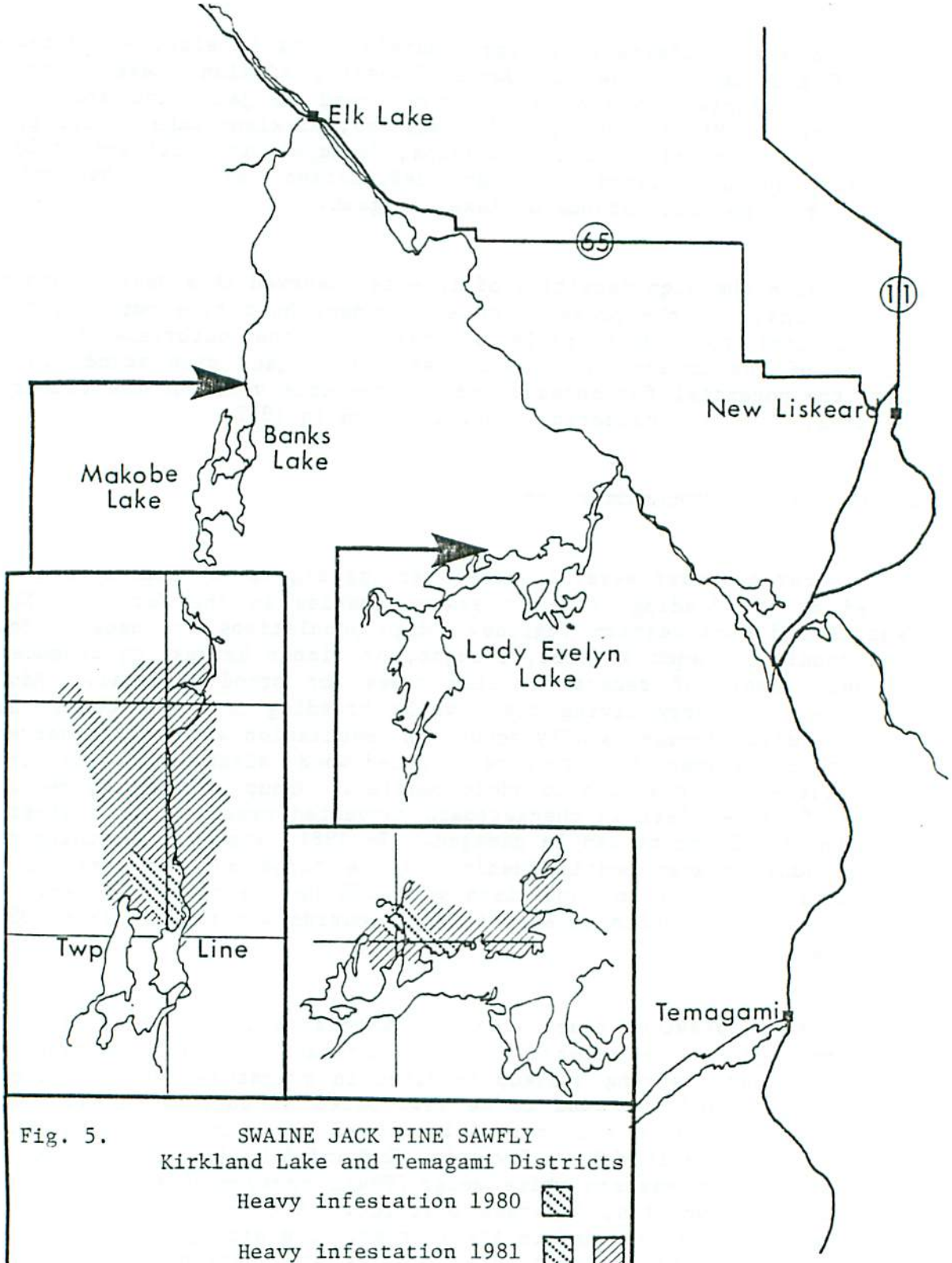

Fig. 5. SWAINE JACK PINE SAWFLY
Kirkland Lake and Temagami Districts

Heavy infestation 1980

Heavy infestation 1981

Map Scale 0 Miles 8 — 0 Km 13

Insert Scale 0 Miles 4 — 0 Km 6

District. A total of about 8 ha of 15 m jack pine were killed at the two sites in Timmins District and about 2 ha of 10 m jack pine were heavily damaged near Wade Lake. In Neelands Township, Chapleau District, where harvesting operations are being carried out in a checkerboard pattern, adult feeding on the fringes of residual blocks of 15 m jack pine caused about 5 ha of severe damage. No new damage was encountered in Fushimi Township, Kapuskasing District where adult beetles severely damaged residual blocks of 70-year-old black spruce in 1980. Damage was greatly reduced in Hopkins Township, Hearst District where black spruce seed tree islands were heavily attacked last year. About 4 ha of new mortality occurred this year and some 24 ha of 19 m black spruce suffered sporadic feeding damage.

The most dramatic decrease in populations occurred in the North Central Region where adult feeding damage was negligible in comparison with the approximately 80 ha of moderate-to-severe damage recorded in 1980. New infestations were found in Clayet Township, Geraldton District where adult feeding was evident on about 6 ha of 12 m black spruce and white spruce around the fringe of a clear-cut area. There was somewhat more severe feeding damage on scattered residual 10 m black spruce and white spruce within a 60 ha clear-cut area near the junction of the Garden and Chisamore roads in Thunder Bay District. Elsewhere in the North Central Region populations were low and damage was insignificant.

In the Northwestern Region, sawyer beetle damage was associated with cutting operations in Red Lake and Fort Frances districts. In Red Lake District, heavy feeding was observed along the fringes of several recently harvested areas near Anderson and Coli lakes where about 5 ha of mature jack pine were affected. Approximately 4 ha of jack pine regeneration, about 1 m in height, were seriously damaged in areas adjacent to stockpiled wood near Barker Lake, Fort Frances District. Although mortality was not detected in either district this year, it will likely become evident in both by 1982. Areas in Sioux Lookout and Ignace districts where heavy feeding damage occurred in 1980 suffered only trace damage in 1981.

An interesting phenomenon was observed east of Kenora in the Kenora District, and near Ten Mile Lake in the Ignace District, where huge numbers of jack pine trees were infested by sawyer beetle following large fires in May and June, 1980. Examination of these areas in early August, 1981 revealed that large numbers of sawyer beetles had emerged from infested trees, an indication that the insect had completed its life cycle in some 14 months or less. At both locations, feeding by adult beetles was apparent but no large-scale serious damage to residual trees was found.

Maple Decline

Decline of maple trees, mostly in urban areas, intensified in 1981. Damage appeared to be greatest in parts of the Eastern, Northeastern and Southwestern regions. The cities and towns most affected were Ottawa, Athens, Kemptville, Perth and Smiths Falls in the Eastern Region; North Bay and Sundridge in the Northeastern Region; and Goderich in the Southwestern Region. In some respects, symptoms of the decline in these places were distinct from the general maple decline disease pattern of progressive crown deterioration. Affected trees seemed to leaf out normally in late May and early June, after which leaves yellowed and dropped. Entire trees or large sections of crown died, and in most instances large portions of bark were loosened, often sloughing off the affected parts.

There was no evidence that insects or diseases were primary or contributing factors. Also, no apparent abiotic cause explains tree reaction. Early reconnaissance of maple populations is planned for 1982 in case the problem continues to plague these towns and cities.

SPECIAL SURVEYS

White Spruce Plantations

In recent years, the FIDS field program has included surveys to obtain baseline data on various insect pests and diseases affecting high-value forest stands or plantations of the major tree species under regeneration in Ontario. White spruce plantations were surveyed in northern Ontario in 1978, jack pine and red pine (*Pinus resinosa* Ait.) in northern and southern Ontario, respectively, in 1979 and black spruce and white pine in northern and southern Ontario, respectively, in 1980.

In 1981, FIDS staff carried out special pest surveys of white spruce plantations throughout Ontario. The purpose of this survey, as it has been for previous surveys, was to obtain baseline information about pests affecting high-value stands and to compare results with those of the previous special survey for white spruce in 1978. Each survey technician attempted to sample six plantations, two in each of three height categories: < 2m, 2-6 m, and > 6 m. A total of 74 plantations were sampled, and in each, 10 plots containing 15 white spruce trees apiece were examined and rated for pest damage if present. Two visits were made to each of the locations because of the differences in

occurrence of the various pests. The first visit was scheduled between 10 and 30 June and the second between 15 and 31 July.

In summary, the 1981 survey showed that a variety of insects and diseases were present in white spruce plantations. Considerable damage was caused by spruce budworm in some situations; otherwise, levels of insects and diseases and of the damage caused by them were generally low and of minor concern. Current frost damage was found in 28% of the plantations; however, actual foliar damage was light.

Insects: By far the commonest pest found in white spruce plantations in 1981 was the spruce budworm. This insect was present in 69% of the plantations, with a higher proportion infested in northern Ontario (84%) than in southern Ontario (47%) (Table 5). Of the 11,030 trees examined in this survey, 3,947 or 36% were infested with spruce budworm. However, with three exceptions, defoliation was generally light (less than 10%, which is not particularly serious even on small trees). In the Northern and Northeastern regions, three plantations between 12 m and 14 m in height suffered defoliation ranging from 50% to 75%. This represents a fairly serious problem on trees of this size. Growth will be slowed and there may be some tree mortality if budworm populations are not controlled. White spruce plantations that have been heavily defoliated for several consecutive years are likely to be more subject to invasion by organisms such as root rot and are undoubtedly more susceptible to secondary organisms such as bark beetles.

Other defoliating insects found were spruce coneworm (*Dioryctria reniculelloides* Mut & Mun.) in 16% of the plantations, spruce bud moth (*Zeiraphera canadensis* Mut & Free.) in 49% of the plantations, eastern blackheaded budworm (*Acleris variana* [Fern.]) in 18% of the plantations and yellowheaded spruce sawfly (*Pikonema alaskensis* [Roh]) in 28% of the plantations. The spruce bud moth was particularly common in the Central, North Central and Northwestern regions whereas the yellowheaded spruce sawfly was common only in the Northwestern Region. In all cases, populations of these insects were low and the resultant damage was negligible or light. Spruce gall adelgids (*Adelges* spp.) were found in 36% of the plantations and white pine weevil (*Pissodes strobi* Peck) in 15%. Damage caused by these latter two insects was light.

Diseases: Armillaria root rot (*Armillaria mellea* [Vahl ex Fr.] Kummer) was detected in five plantations. This root rot was not encountered in a sub-sample of 220 trees from which increment cores were taken. In fact, only 2.3% of the trees sampled for root

rot had internal rot. The only pathogen successfully cultured was *Polyporus tomentosus* Fr., isolated from one tree. In general, the data indicate that the level of root rot activity in plantations averaging 29 years of age (ranging from 16 to 41 years) is probably low. Also found in 31% of the plantations were needle rusts of spruce (*Chrysomyxa ledi* [Alb. and Schw.] d By. and *C. ledicola* Lagh.). Damage, however, was negligible or light.

Approximately 10% of the spruce trees in two stands were affected with chlorosis, and in six stands it was found at trace levels. The occasional chlorotic tree encountered probably represents localized adverse site conditions or early symptoms of root rot. White spruce can suffer considerable frost damage, depending on the year. In 1981, frost damage occurred in 28% of the plantations sampled; however, actual foliar damage was trace to light in all cases except one, where trees less than 2 m high suffered moderate foliar damage.

Seed and Cone Insects of White Spruce

In response to concern expressed by foresters about seed production and problems connected with it, a special survey was made in 1981 to determine the extent and causes of damage to the flowers and cones of white spruce. Collections were made of 200 female flowers and of 100 current-year cones. These were assessed at the Great Lakes Forest Research Centre for the proportion of damaged cones and the insects or diseases responsible for the damage were identified.

In the northern portion of the province, spruce budworm attacked only up to 2% of the flowers at the time of sampling. Howver, feeding would have continued after that time. In southern Ontario, up to 11% of the flowers were attacked. Damage to flowers or cones by feeding of lepidopterous larvae is quite characteristic but in the absence of insects, specific identification is not possible. However, reasonable inferences can be drawn from associated data. Thus, in the North Central Region, 65% of the female flowers were damaged. Only 1% of the flowers had budworm present, but the spruce bud moth was abundant and it is postulated that the unknown lepidoptera were in fact largely *Zeiraphera canadensis*.

Similarly, in the Northeastern Region, where 11% of the flowers had budworm present and 51% of the cones were damaged by "lepidoptera", it would be reasonable to infer that budworm was the significant factor.

Table 5. Spruce budworm incidence and damage in white spruce plantations in Ontario in 1981.

Region	Number of plantations examined	Number of infested plantations	Trees affected (average current defoliation) (%)		
			Trees under 2 m	Trees 2.1 to 6.0 m	Trees over 6 m
Northwestern	8	6	2 (1)	3 (1)	5 (1)
North Central	11	7	5 (1)	17 (1)	84 (1)
Northern	12	12	30 (1)	85 (5)	98 (42)
Northeastern	13	12	49 (6)	60 (7)	96 (31)
	44	37	22 (2)	47 (5)	76 (21)
Algonquin	11	3	15 (5)	32 (5)	25 (5)
Eastern	6	2	0 (0)	2 (1)	16 (5)
Central	5	5	23 (2)	38 (3)	100 (7)
Southwestern	8	4	7 (1)	27 (6)	51 (18)
	30	14	10 (3)	27 (4)	37 (10)
Over all	74	51	18 (2)	39 (5)	58 (17)

Spruce coneworm was detected only in the Algonquin and Eastern regions of southern Ontario and in the North Central and Northeastern regions of northern Ontario. A third lepidopteran, the spruce seed moth (*Laspeyresia youngana* [Kft.]), was abundant in the North Central and Northeastern regions and was present in smaller numbers throughout the rest of northern Ontario. It was abundant only in the Algonquin Region and the only other region in which it was present was the Eastern Region. This insect feeds through the seed zone of the cone and is very destructive.

The spruce bud moth was very destructive to the flowers in the Algonquin, Eastern, Central and North Central regions of Ontario.

A dipterous pest, the spruce cone maggot (*Hylemya anthracina* [Czerny]), feeds as a maggot in the seed zone of the cone and is very destructive. It was very abundant in all regions throughout the province except the Northern Region, where it was less common.

A second dipterous pest, the spruce cone gall midge, (*Dasineura canadensis* Felt), also feeds in the seed zone, and was present across the province except in the North Central Region. It was present in low-to-high numbers (1-43% of cones) and was most prevalent in the Algonquin and Northeastern regions.

In southern Ontario the proportion of damaged cones ranged from 67% to 88% (Table 6). *H. anthracina* and *D. canadensis* were major factors throughout the south, and *L. youngana* was a major factor in the Algonquin Region.

In northern Ontario the proportion of damaged cones ranged from 20% to 94% (Table 6). *H. anthracina* and *L. youngana* played major roles in the North Central and Northeastern regions. Lepidoptera-caused damage was prevalent in the Northwestern, Northern and Northeastern regions, although there were few instances of heavy damage by this source.

The overall impact resulted in a diminishing of the number of sound cones by up to 96% in some areas. Twenty-three species of insects were encountered in the survey. It is evident that these have a profound effect on the quality of white spruce cone production in Ontario.

Table 6. Percentage of white spruce cones damaged by insects in 1981.

Region	No. of cones examined	Cones damaged (%)	No. of cones damaged by[a]	
			Lepidoptera	Other insects
Northwestern	205	55	64	48
North Central	211	94	71	127
Northern	100	20	15	5
Northeastern	220	81	78	206
Algonquin	100	69	31	64
Eastern	100	67	54	47
Central	146	88	96	113
Southwestern	100	84	35	49
Over all	1182	72	444	659

[a] Damage may be caused to an individual cone by one or more insects.

Pest Surveys in Tree Seed Orchards

Three seed orchards and a seed improvement area in the Central Region and a seed orchard in the North Central Region were examined for seed and cone pest damage in August, 1981. Locations, host species involved and the percentage of cones affected by insects are listed in Table 7.

Cones were not abundant at any of the locations; they were particularly scarce at the F-Tract and Orono sites and no cones could be found at the Thunder Bay site. The field examination involved sampling two cones from at least 25 randomly selected trees if a sufficient number of cone-bearing trees was present. The cone samples were forwarded to the Great Lakes Forest Research Centre where they were examined by an entomologist.

White spruce cones at the F-Tract, Glencairn and Ballycroy sites were seriously damaged, with the spruce seed moth causing the most damage. Also present were the spruce cone maggot, the spruce cone gall midge and damage from earlier Lepidoptera insects that could not be identified by species. In comparison, the black spruce cones at Glencairn were of good size, well formed and virtually insect free. Some damage was evident from earlier Lepidoptera insects.

Table 7. Summary of insect damage to cones at five seed orchards in 1981.

Location	Species	No. of cones examined	Cones damaged by insects (%)
Central region			
Huronia District			
F-Tract Seed Orchard	wS	51	90
Ballycroy Seed Improvement Area	wS	61	75
Glencairn Seed Orchard	wS	88	68
	bS	100	14
Lindsay District			
Orono Seed Orchard	wP	29	55
North Central Region			
Thunder Bay District			
Mattawin Seed Orchard	wS	no cone crop	
	bS	no cone crop	

At Orono, white pine cones were most heavily damaged by the white pine coneworm (*Eucosma tocullionana* Heinr.). Gall midges (Cecidomyiidae) and the fir coneworm (*Dioryctria abietivorella* [Grt.]) were present at low levels.

Cones could not be found on either white spruce or black spruce at the Mattawin seed orchard. This location has been sampled since 1978 for spruce budworm, which is present at relatively low levels.

Pine Wood Nematode (*Bursaphelenchus xylophilus* [Steiner and Buhrer] Nickle)

Increment cores were collected from symptomatic pine trees in 31 locations in Ontario and sent to the FIDS Unit at the Great Lakes Forest

Research Centre to be examined for the presence of the pine wood nematode. At the time of collection, all cores were placed in test tubes containing water. In the laboratory, water samples from these tubes were examined under the microscope for the presence of *B. xylophilus*. All samples proved to be negative for this tree pest. It is planned to continue this sampling in 1982.

CONTROL PROGRAMS

Spruce Budworm

The Ontario Ministry of Natural Resources aerially sprayed about 5,263 ha of commercial forest and about 4,970 ha of high-value forest in 1981. As in 1980 there were three parts to the program.

1) For the second consecutive year a large area (5,263 ha) of mature balsam fir and white spruce in Elliott Township, Kirkland Lake District was treated to decrease damage until such time as harvesting can take place. Two AgCats (spray aircraft) were used to treat the area with both chemical and biological insecticides. Matacil (86 g/3.0 L/ha) was applied to 2,424 ha while two *B.t. (Bacillus thuringiensis)* formulations, Dipel 88 (20 BIU/5.1 L/ha) and Thuricide 16B BIU/ 6.2 L/ha), were applied to 2,839 ha. Another 262 ha were given a double application of Thuricide at a rate and dosage of 16 BIU/6.2 L/ha per application. The operational costs for spraying (materials + aircraft) were $9.43/ha for Matacil, $21.44/ha for Dipel, $16.71/ha for the single application of Thuricide and $33.44/ha for the double application. Excellent results were achieved on balsam fir with all treatments. Matacil and Thuricide provided equally good protection on white spruce whereas Dipel was less effective.

2) A total of 4,350 ha of high-value forest (nurseries, seed production areas, provincial parks, etc.) in Hearst, Kapuskasing, Temagami, Chapleau, Kirkland Lake and Gogama districts was sprayed with various insecticides from both fixed-wing aircraft and helicopters. In an effort to protect female flowers several white spruce and black spruce Seed Production Areas were treated early with a double application of Matacil at a cost of about $36.00/ha. Results of this operation in terms of foliage protection and larval mortality were unsatisfactory. An assessment could not be made in terms of flower protection because very few flowers were produced in 1981. Matacil, *B.t.*, and the nuclear polyhedrosis virus were used in the rest of the high-value areas at costs ranging between $36 and $45 per ha.

Results were quite variable and in some areas very difficult to interpret because of low budworm populations.

3) In 1981, for the second consecutive year, 620 ha of a wildlife management area (deer yard) in Spence Township, Parry Sound District were treated. Dipel 88 (24 BIU/7.0 L/ha) was applied to 296 ha at a cost of $32.79/ha. In terms of population reduction and foliage protection, excellent results were achieved with this treatment. The other 324 ha were treated with Thuricide 32 BX (20 BIU/4.7 L/ha), a *B.t.* formulation that has not been used before in Ontario. Results of this treatment were not as good as those in the Dipel treated area, especially on white spruce.This may be due, in part, to the poor spray deposits recorded in some areas treated with this product. Cost estimates are not available for this particular treatment.

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OTHER NOTEWORTHY INSECTS AND DISEASES

Forest pests of lesser importance in 1981 are included in the following tables to provide information on the history and fluctuation in populations of these pests. For example, although the forest tent caterpillar was written up as a major pest this year, populations declined to low levels in 1981 after several years of severe, widespread outbreaks. This pest will likely be mentioned only in the tables in the 1982 report. Undoubtedly, populations of this insect will start increasing in a few years and the forest tent caterpillar will again become a major pest throughout Ontario. Many other organisms may never become problems at the provincial or even forest region level but they can cause significant damage in local situations.

Forest insect pests and diseases are listed alphabetically by common name. Each organism listed is rated according to its importance as follows:

A - of major importance, capable of killing or severely damaging trees or shrubs;

B - of moderate importance, capable of sporadic or localized injury to trees or shrubs;

C - of minor importance, not known to present a threat to living trees or shrubs.

OTHER NOTEWORTHY INSECTS AND DISEASES

Insect or disease	Host(s)	Location	Remarks	Rating
Ambermarked birch leafminer *Profenusa thomsoni* (Konow)	Birch, white	Albany Forks, Sioux Lookout and Red Lake	increasing populations with heavy damage in the northwest	B
American aspen beetle *Gonioctena americana* (Schaef.)	Aspen, trembling	CFB Borden, Algonquin Region, northern Ontario	severe damage; declining populations in Algonquin and the north except for high numbers near Cochrane and Chapleau	B
Aspen leafblotch miner *Phyllonorycter ontario* (Free.)	Aspen, trembling	Northern Ontario	Populations increased in the western parts of the province but decreased east of Nipigon.	B
Aspen leafroller *Pseudexentera oregonana* Wlshm.	Aspen, trembling	Northeastern Region	declining populations throughout the Region except for pockets north of Lake Huron, where damage was moderate to severe	A
Balsam fir sawfly *Neodiprion abietis* complex	Fir, balsam	Huronia, Moosonee, Pembroke, Espanola and Owen Sound Districts	declining populations; low levels except near Medonte Twp, Huronia District	A
Balsam poplar leaf beetle *Chrysomela walshi* Brown	Poplar, balsam	Temagami, Chapleau, Gogama and Kapuskasing Districts	light-to-moderate defoliation	C
Balsam poplar leafblotch miner *Phyllonorycter nipigon* (Free.)	Poplar, balsam	Thunder Bay District and Northwestern Region	High numbers recurred, with smaller numbers in the northwest.	B
Beech scale *Cryptococcus fagisuga* Lindinger	Beech	Holland Landing, Maple District	one collection of this rare insect	B

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Birch leafminer *Fenusa pusilla* (Lep.)	Birch, white	Northwestern Ontario	generally low numbers	A
		Northeastern and southern Ontario	moderate-to-severe defoliation continuing throughout the areas noted	
Birch skeletonizer *Bucculatrix canadensisella* Cham.	Birch, white	Northern Ontario	increasing populations with extensive areas of heavy defoliation	A
		Southwestern Region	increasing populations with pockets of severe damage	
Bronze birch borer *Agrilus anxius* Gory	Birch, white	Red Lake District	serious damage and heavy mortality throughout 1700 km^2 of forest; an eightfold increase in area	B
Brown spot needle blight *Scirrhia acicola* (Dearn.) Siggers	Pine, mugho, Austrian	Huronia and Owen Sound districts	Caused defoliation of mugho and Austrian pine in Sauble Falls Provincial Park. An infection on Austrian pine was found in Tiny Township in 1981 and is the second known location of the fungus in Ontario.	A
Cedar leafminers *Argyresthia aureoargentella* Brower, with *A. canadensis* Free., *A. thuiella* (Pack.) and *Pulicalvaria thujaella* (Kft.)	Cedar, eastern white	Southern Ontario	A slight population increase in Algonquin Region was offset by declining areas of infestation throughout the remainder of the province Tip and tree mortality have increased where infestations have persisted.	A
Cherry casebearer (formerly aspen casebearer) *Coleophora pruniella* Clem. (formerly *C. innotabilis* Braun)	Poplar, balsam Birch, white	Central Region	small discrete pockets of moderate-to-severe damage; declining elsewhere	C

(cont'd)

OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Cherry scallopshell moth *Hydria prunivorata* Ferg.	Cherry, black, pin	Uxbridge Township, Maple District; St. Williams Forest Station, Simcoe District	heavy infestations with severe browning of foliage and defoliation	B
Eastern blackheaded budworm *Acleris variana* (Fern.)	Spruce, white	Central, Southwestern and Northwestern regions	light and declining infestations	B
Eastern pine shoot borer *Eucosma gloriola* Heinr.	Pine, jack, red, white, Scots	Province-wide	generally light or moderate damage; up to 23% damaged leaders in jack pine regeneration in the Northwestern Region	B
Eastern spruce gall adelgid *Adelges abietis* (L.)	Spruce, white	Northern Ontario and Southwestern Region	first records at Fort Frances, Dryden, Kenora and Sioux Lookout; generally low numbers in north; tree mortality noted in Killarney Township; insect common near Woodstock	B
Elm leafminer *Fenusa ulmi* Sund.	Elm, white	Pembroke, Owen Sound and Cambridge districts	moderate-to-high populations, mostly on regeneration elm	B
European fruit lecanium *Lecanium corni* Bouché	Oak, English	Port Perry	Heavy infestation on four trees	B
	Basswood	Brockville District	Common on host trees	
European pine needle midge *Contarinia baeri* (Prell)	Pine, Scots, red	Southern Ontario	declining populations but increasing distribution	B

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
European pine sawfly *Neodiprion sertifer* (Geoff.)	Pine, Scots, mugho, red	Sault Ste. Marie, Thessalon, Manitoulin Island	Low populations prevailed at these locations, marking a decline in the Northeastern Region.	A
		Minden Township	A collection north of Bobcaygeon was a first survey record for this locality.	
		Pembroke, Bancroft, Aylmer and St. Thomas	Generally low populations	
European pine shoot moth *Rhyacionia buoliana* (Schiff.)	Pine, red	South of Georgian Bay	several scattered areas of heavy infestation in which trees are distorted; populations stable	A
Fall cankerworm *Alsophila pometaria* (Harr.)	Various hardwoods	Fort Frances and Dryden	heavy defoliation within towns	A
		Vineland to Niagara Falls	new heavy infestations with 50% or more defoliation	
		Brantford	moderate numbers	
Fall webworm *Hyphantria cunea* (Dru.)	Hardwoods	Stranger Lake, Ignace District; Claxton Township, Fort Frances District and McIntyre Township, Thunder Bay District	scattered colonies	B
		Tekhummah Township, Espanola District	population increase, with moderate defoliation of white ash	
		Northeastern Region	common throughout region	
		Southern Ontario	population increases with heavy infestations throughout the area	

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hirat.	Pine, jack	Northwestern, Northern, North Central, and Northeastern regions	common through these regions; one plantation near Sioux Lookout with 17% stem infections and one near Dryden with 19%; no mortality found that was due to this fungus	A
Greenstriped mapleworm *Dryocampa rubicunda rubicunda* (F.)	Maple, red	Blind River District, Fort Frances District, Nattawa	sharp decline, with low numbers; moderate damage to scattered trees	A
Hemlock looper *Lambdina fiscellaria fiscellaria* (Gn.)	Hemlock	Minden and Bancroft districts	population collapsed	
Ink spot *Ciborinia whetzelii* (Seaver) Seaver	Aspen, trembling	Province-wide	generally low-to-moderate levels, but 80% defoliation noted on semi-mature trees in Fraser and McKay townships, Pembroke District	A
Jack pine budworm *Choristoneura pinus pinus* Free.	Pine, jack, Scots	Kirkwood Township, Blind River District	very light numbers	A
		Oro, Essa and Tosorontio townships, Huronia District; Maryborough Township, Cambridge District	low numbers, but common in plantations	
Jack pine sawflies *Neodiprion pratti banksianae* Roh.	Pine, jack	Geraldton, Geraldton District; London, Aylmer District, and Palgrave, Maple District	light infestations	A
		Tosorontio Township Huronia District	new location of light damage	

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Neodiprion pratti paradoxicus Ross	Pine, jack	Algonquin Park District	High populations caused moderate-to-severe defoliation of immature fringe trees and pole-size trees (30-50% defoliation)	
Jack pine tip beetle *Conophthorus banksianae* McP.	Pine, jack	Northern Ontario	Numerous locations had up to 12% of leaders killed in the Northern and Northeastern regions	C
		Red Lake and Sioux Lookout districts	small numbers on regeneration	
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack	Province-wide	generally a decline to low levels of infestation	B
		Minesing swamp, Huronia District	area of heavy infestation reduced to 200 ha.	
		Perry and Stisted townships, Bracebridge District	thirteen 21 m trees and eleven 17 m trees, respectively, killed	
	Larch, European	London, Owen Sound	moderate-to-heavy infestations, defoliation up to 50%	
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Province-wide	generally a decline to low levels of infestation	A
		Terrace Bay District	tree mortality reaching 60% of pole-sized trees in a 1 ha stand	
		Geraldton	new infestation north of town in a 5 ha stand	

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Larch sawfly *Pristiphora erichsonii* (Htg.)	Larch, European	Central Region	numerous pockets of moderate-to-severe defoliation	
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Aspen, trembling	CFB Borden	moderate-to-severe defoliation	B
		Essa, Sunnidale, Flos, Tecumseh and W. Gwillimbury townships, Huronia District	small areas of moderate damage totalling 50 ha	
		Pefferlaw and King Township, Maple District	severe defoliation over 60 ha	
		Cambridge and Lindsay districts	Previous infestations declined to low levels.	
Leaf blight *Linospora arctia* var. *helvetica* Rehm.	Willow, shining	Grundy Lake Provincial Park, Parry Sound District	the first record of this fungus in North America; limited to a small Willow plantation in the park	B
Leaf spots				
Cylindrosporium juglandis Wolf	Walnut	Blenheim Township, Cambridge District	high level of incidence in a walnut plantation; first collection of this fungus by the FIDS Unit in Ontario	C
Mycosphaerella populicola G.E. Thomps.	Poplar, balsam	Cambridge, Huronia Lindsay, Ottawa, and Thunder Bay districts	Although the disease is province-wide, these districts reported stands with severe defoliation. One stand in the Cambridge District had many trees completely defoliated.	B
Linden looper *Erannis tiliaria* (Harr.)	Basswood	Tavistock, Aylmer District	A population increase failed to materialize.	B

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Maple leafcutter *Paraclemensia acerifoliella* (Fitch)	Maple, sugar	Bolingbroke, north of Kingston	heavy feeding throughout 1,300 km^2 centring on this locality	
		Robertson Tract of Halton Regional Forest, Cambridge District	heavy damage to 15 ha of semimature trees, average 50% defoliation	
		Lindsay and Minden districts	light-to-medium defoliation	
Maple leafroller *Cenopis acerivorana* Mack	Maple, red, sugar	Sault Ste. Marie	high populations in the northeastern part of the city	C
		Southern Ontario	low numbers throughout	
Maple trumpet skeletonizer *Epinotia aceriella* (Clem.)	Maple, sugar	Pearce Provincial Park, Aylmer District	marked population increase; 68 ha with 40-60% defoliation	C
		Sauble Beach, Owen Sound District	40 ha moderately to severely defoliated	
		Ridout Township, Bracebridge District	moderate damage to ornamentals	
Maple webworm *Tetralopha asperatella* (Clem.)	Maple, sugar	Woolwich Township, Cambridge District	previous heavy defoliation reduced to medium levels over 10 ha	C
		Wilmot and N. Dumfries townships, Cambridge District; Essa and Nedonte townships, Huronia District	common at low levels	

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Mountain-ash sawfly *Pristiphora geniculata* (Htg.)	Mountain-ash	Fort Frances	another westerly extension of 100 km; only within town limits	A
		Northern Ontario	high populations remaining	
		Southern Ontario	light-to-moderate defoliation	
Needle casts				
Davisomycella ampla (Davis) Darker	Pine, jack	Province-wide	trace-to-low levels reported	A
Lophodermium australe Dearn.	Pine, jack	Blind River and North Bay districts	Apparently this is the first collection of this fungus in Canada. One plantation was infected in each district with an incidence of 90% or more.	C
Lophodermium seditiosum Minter, Staley & Millar	Pine, red	Gurd Township, North Bay District	This is the first record of this fungus for the FIDS Unit in Ontario but it is suspected that earlier collections were identified as *Lophodermium pinastri* (Schrad. ex Hook.) Chev.	A
Naemacyclus minor Butin	Pine, mugho, Scots	Huronia and Owen Sound Districts	associated with dead needles of mugho pine in Sauble Falls Provincial Park and of Scots pine in a Christmas tree plantation; pathogenicity undetermined	A
Needle blight *Scirrha pini* Funk & A. Parker	Pine, Austrian	Huronia and Owen Sound districts	infection levels up to 60% in some plantations; many other areas damaged but to a lesser extent	A

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Needle rust				
Chrysomyxa ledi (Alb. & Schw.) d By.	Spruce, white, black	Northwestern, Northern, North Central and Northeastern regions	present at only low or trace levels; small, localized areas with incidence exceeding 60% noted in Rabazo and Lendrum townships, Wawa District, and at Victoria Lake, Ignace District	B
Northern pine weevil *Pissodes approximatus* Hopk.	Pine, eastern white, Scots	Flos Township, Huronia District; Edwardsburg Township, Brockville District	mortality of seedlings; 3% mortality in a 5 ha plantation	B
Orangestriped oakworms *Anisota finlaysoni* Riotte	Oak, bur	Brantford, Milton	low populations	A
Anisota senatoria (J.E. Smith)	Oak, white, red	Southwestern Region to Point Pelee National Park	declined to very low population levels	A
Pale spruce gall adelgid *Adelges strobilobius* (Kalt.)	Spruce, black Tamarack	Red Lake, Kenora, Sioux Lookout, Kirkland Lake and Timmins districts	moderate-to-high populations common at many locations	C
Pine false webworm *Acantholyda erythrocephala* (L.)	Pine, red, jack, Scots, eastern white, mugho	Pembroke to Parry Sound and Owen Sound	variable to decreasing populations	A
		Walkerton and North Bay	new distribution records	
		Central and Southwestern regions	moderate-to-severe defoliation; absent from Lake Erie area	
Pine spittlebug *Aphrophora cribrata* (Wlk.)	Pine, Scots, jack, eastern white	Southern Ontario, north to Blind River	up to 97% of trees infested but levels generally low, except near Normandale where noticeable damage occurred	B

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Pine tortoise scale *Toumeyella parvicornis* (Ckll.)	Pine, jack	Blair Township, Parry Sound District	Heavily infested trees increased from 19% to 41% and tree mortality increased from 3 to 6%.	B
		Mowat Township, Parry Sound District	a new, light infestation	
Redheaded jack pine sawfly *Neodiprion virginianus* complex	Pine, jack	Northwestern and North Central regions	low-to-medium populations	A
		Northern and North-eastern regions	Pockets of severe defoliation with up to 265 ha infested near Biscotasing and Chapleau; heavy defoliation at Temagami also	
Redheaded pine sawfly *Neodiprion lecontei* (Fitch)	Pine, red, jack	Southern Ontario	generally low populations with pockets of severe defoliation; serious damage to 6 ha at Hungerford Townsip, and in Vespra and Orillia townships	A
		North Bay District	Populations increased.	
		Blind River District	severe defoliation (76%) with 33% mortality	
Red pine cone beetle *Conophthorus resinosae* Hopk.	Pine, red	Temagami	Heavy infestations recurred	C
Root rots				
Armillaria mellea (Vahl ex Fr.) Kumm.	Pine, red, jack, eastern white Oak, red	Province-wide	mortality ranging from 1 to 17% noted in a number of pine plantations; associated with a pocket of 35-40 dead or dying semimature red oak in Hedonte Township, Huronia District	A

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OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Cylindrocladium floridanum Sob. & Seymour	Spruce, black Pine, red	Orono and G. Howard Ferguson provincial forest nurseries	a cause of root rot on red pine in one compartment at the G. Howard Ferguson nursery and in potted black spruce at the Orono nursery	A
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Maple, sugar Oak, red	Central Ontario	light defoliation at Awenda Provincial Park, Huronia District and on sugar maple in Ridout, Bethune, Proudfoot, Sinclair and Franklin townships, Bracebridge District	A
Red pine sawfly *Neodiprion nanulus nanulus* Schedl.	Pine, red, jack	Province-wide	low populations and scattered colonies	B
Satin moth *Leucoma salicis* (L.)	Poplar, Lombardy, silver	Eastern Region	No insects were found.	B
Sawyer beetles *Monochamus* spp., mostly *scutellatus* (Say)	Pine, jack, red Spruce, black, white Cedar, white	Northern, North Central and Northwestern regions	adult feeding damage common on trees adjacent to log piles; many pockets of severe defoliation and flagging with associated tree mortality	A
		Owen Sound	light feeding on red pine twigs	
Shoot blights				
Sirococcus strobilinus Preuss	Pine, red	Sioux Lookout and Atikokan districts	found causing light damage on red pine regeneration in three locations	A
Venturia macularis (Fr.) Muller & Arx	Aspen, trembling	Province-wide	Damage levels varied from trace to low in most areas. Stands in which infection equaled 80% or more were located in Sudbury, Bancroft, and Pembroke districts.	A

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OTHER NOTEWORTHY INSECTS AND DISEASES (concl'd)

Insect or disease	Host(s)	Location	Remarks	Rating
White pine blister rust *Cronartium ribicola* J.C. Fisch.	Pine, white	Province-wide	branch cankers recorded on 35% of the semimature white pine trees in Sioux Narrows Provincial Park; low-level mortality, 1% or less, noted in a number of plantations across the province	A
White pine weevil *Pissodes strobi* (Peck)	Pine, eastern white, jack Spruce, black, white	Province-wide	Populations remained stable in northern Ontario--lower than in southern Ontario where up to 90% of leaders were attacked.	A
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Spruce, white, black	Northern Ontario	pockets of moderate-to-severe defoliation throughout the north, with some light tree mortality near Dryden	A
		Southern Ontario	light damage in the Eastern and Southwestern regions, with moderate damage scattered through the rest of the area	
Yellownecked caterpillar *Datana ministra* (Dru.)	Elm, white basswood	Kingston, Trenton, Langton, Lindsay	pockets of moderate-to-severe defoliation	C
	Birch, white	Pointe au Baril, Parry Sound District	severe defoliation; first survey record for this locality	
Zimmerman pine moth *Dioryctria zimmermani* (Grt.)	Pine, eastern white, red	Mulmur, Essa, Tosorontio and Sunnidale townships	moderate and heavy damage to 300 ha of red pine	C
		Uxbridge and Albion townships	Pole-size trees had conspicuous damage.	

OTHER NOTEWORTHY INSECTS AND DISEASES (cont'd)

Insect or disease	Host(s)	Location	Remarks	Rating
Solitary oak leafminer *Cameraria hamadryadella* Clem.	Oak, bur, red	Eastern Region	Moderate-to-severe defoliation continued.	B
		Milton	moderate numbers on roadside oak	
Spearmarked black moth *Rheumaptera hastata* (L.)	Birch, white	Oba Lake, Wawa District to Chapleau	7,729 km^2 of severely browned foliage and premature leaf drop	B
		Owen Sound	trace levels	
Spruce bud moth *Zeiraphera candensis* (Mut & Free.)	Spruce, white, Norway	Between towns of Nipigon and Dorion, Nipigon District	scattered pockets of heavy defoliation of open-grown trees	B
		West and south of Toronto to St. Williams	severe damage in numerous locations	
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce, white	St. Vincent Township, Owen Sound District	82% of trees damaged	C
		Wells Township, Blind River District	high numbers on occasional trees	
Tip blight *Sphaeropsis sapineau* (Fr.) Dyke and Sutton	Pine, Scotch, red, jack ponderosa	Southwestern, Central Eastern, and Northern regions	a common cause of tip dieback on conifers, particularly in southern Ontario	A
Walnut caterpillar *Datana integerrima* G. & R.	Butternut Elm, white Walnut, black	Eastern, Central and Southwestern regions	Populations continued to increase, with heavy damage over most of area. Up to 100% defoliation was common.	B

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